SMART ELECTRICITY BILL MANAGEMENT SYSTEM

ICT 305 2.0

EMBEDDED SYSTEM

UNIVERSITY OF SRI JAYEWARDENEPURA

G.A.N.K. JAYALATH

R.P. YATALAMATHTHA

ABSTRACT

The rapid rise in monthly electricity bills can be seen as a problem that can be seen in many homes as well as office premises these days. Residents are facing a big crisis due to this increasing electricity bill management system is presented to manage this electricity bill which has increased rapidly due to the current crisis in the country.

Here, the main problem is that a large amount of electricity is wasted due to the unnecessary lights' bulbs and electrical appliances in the house. Due to this, the electricity bill in many houses increases rapidly. As a solution to this problem, The SEMS mentioned above, It helps to reduce our monthly electricity bill in a way that we expect. After entering the expected electricity bill for the month, this SEMS will inform the mine that the electricity should be adjusted accordingly and efficiently control the electricity that is used unnecessarily due to our careless behavior or in some other way.

Due to this system, which works automatically whenever you are at home, it is possible to solve the above-mentioned problems very easy.

ACKNOWLEDGMENT

I would like to place on record my deep sense of gratitude to Dr.M.D.R. Perera, Senior lecture in Computer Science, Department of Computer Science, Faculty of Applied Science, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka for his generous guidance, help and useful suggestions. I express my sincere support to the embedded system project.

CONTENT

01.INTRODUCTION

A problem in many homes is that the monthly electricity bill increases due to the unnecessary high consumption of electricity. Also, many electrical appliances are turned off due to being on for unnecessary time and the electricity is wasted. Also, there are cases where people forget to turn off light bulbs and electrical appliances that are left unnecessarily in the house when they are not at home or when they are away. In those cases, electricity can be wasted, and the equipment can be damaged.

A smart electricity management system can be used as a solution to the problem discussed above. By this, we can prevent the unnecessary wastage of electricity and also minimize the damage caused to the electrical appliances at home. Since electricity is not wasted unnecessarily, the monthly electricity bill can be significantly reduced. When you are out of the house or not at home, you can save electricity and reduce the damage caused to the equipment by being able to control the light bulbs and electrical appliances that are unnecessarily placed in the house from any station you are in.

02.PROJECT AIMS

The main purpose of this system is to reduce the electricity bill as we expect at the end of the month and to be able to control the electricity system of your home or office from anywhere in the world. By this system, many things required to reduce the electricity bill are done by the same system and all the changes are informed by a message.

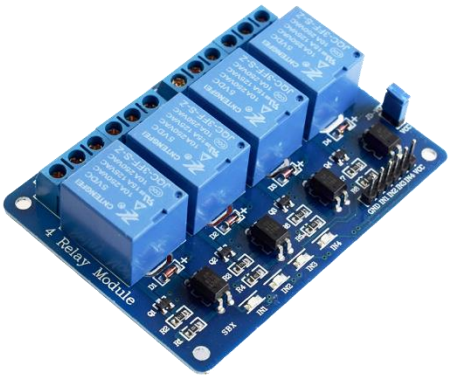
03.COMPONENTS

Node MCU

NodeMCU is an open source LUA based firmware developed for the ESP8266 Wi-Fi chip. By exploring functionality with the ESP8266 c This particular relay module can control typical household appliance up to 10Ahip, NodeMCU firmware comes with the ESP8266 Development board/kit i.e., NodeMCU Development board.

We can also use this NodeMCU for this project.

4 Channel Relay Module



This is a 5V 4-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equipped with high-current relays that work under AC250V 10A or DC30V 10A. It has a standard interface that can be controlled directly by microcontroller.

This relay module can control typical household appliance up to 10A

PIR Sensor Module

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications.

PIR sensors detect general movement, but do not give information on who or what moved. For that purpose, an imaging IR sensor is required.

This sensor is used in thermal sensing applications, such as security and motion detection.

.

LDR Sensor

Photoresistors, also known as light dependent resistors (LDR), are light sensitive devices most often used to indicate the presence or absence of light, or to measure the light intensity. In the dark, their resistance is very high, sometimes up to 1 MΩ, but when the LDR sensor is exposed to light, the resistance drops dramatically, even down to a few ohms, depending on the light intensity. LDRs have a sensitivity that varies with the wavelength of the light applied and are nonlinear devices.

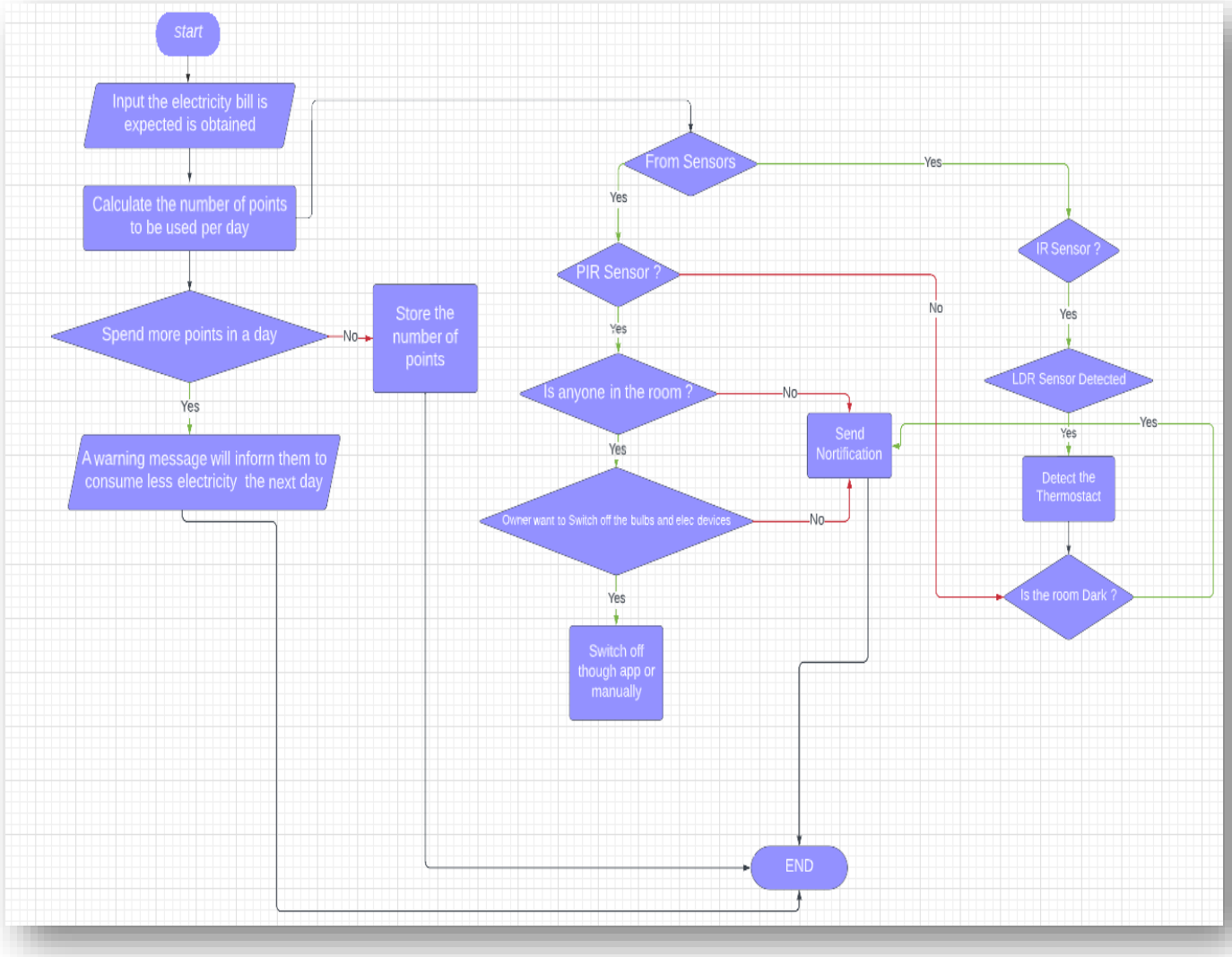
This sensor used to indicate the presence or absence of light, or to measure the light intensity.

04.PROJECT COST

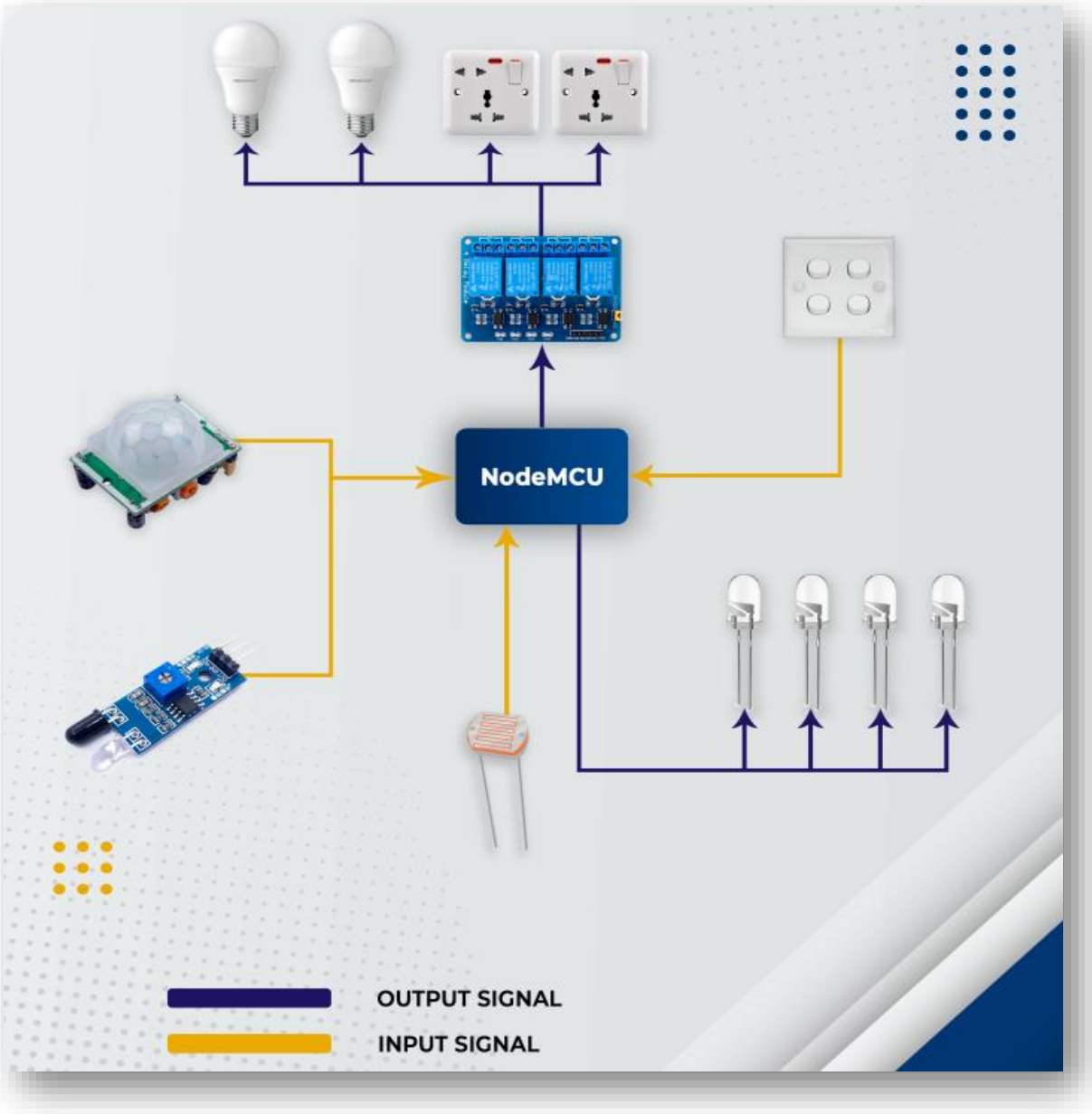
ITEM	COUNT	PRICE Rs.
Node MCU	1	**1550**
4 channel relay modules	1	**760**
PIR sensor	1	**420**
IR sensor	1	**180**
LDR Sensor	1	**30**
4 Gang Wall Switch	1	**660**
13A Plug Base	2	**1045*2**
Sun box	3	**140*3**
15W Led Bulb	2	**520*2**
Dot Board	1	**210**
1W White Led Bulbs	4	**20*4**
Total	**7440**	

05.DESIGN OVERVIEW

5.1 FLOW CHART



5.2 COMPONENT DIAGRAM



5.3 CODE

```
#define BLYNK_TEMPLATE_ID "TMPLsGSshD4G"    //Template ID
#define BLYNK_DEVICE_NAME "NK Smart"

#define BLYNK_FIRMWARE_VERSION "0.1.0"

#define BLYNK_PRINT Serial

#define APP_DEBUG

#include "BlynkEdgent.h"
#include "eBill_Functions.h"

#define Bulb_1_Pin D0
#define Bulb_2_Pin D1
#define Switch_1_Pin D4
#define Switch_2_Pin D5

#define Manual_Switch_1_Pin D6
#define Manual_Switch_2_Pin D7
#define Motion_Sense_Pin D8

float Monthly_Points, Daily_Points;

void setup() {

  pinMode(Bulb_1_Pin, OUTPUT);
  pinMode(Bulb_2_Pin, OUTPUT);
  pinMode(Switch_1_Pin, OUTPUT);
  pinMode(Switch_2_Pin, OUTPUT);

  pinMode(Manual_Switch_1_Pin, INPUT_PULLUP);
  pinMode(Manual_Switch_2_Pin, INPUT_PULLUP);

  pinMode(Motion_Sense_Pin, INPUT);

  digitalWrite(Bulb_1_Pin, 1);
  digitalWrite(Bulb_2_Pin, 1);
  digitalWrite(Switch_1_Pin, 1);
  digitalWrite(Switch_2_Pin, 1);

  Serial.begin(115200);
  delay(100);
```

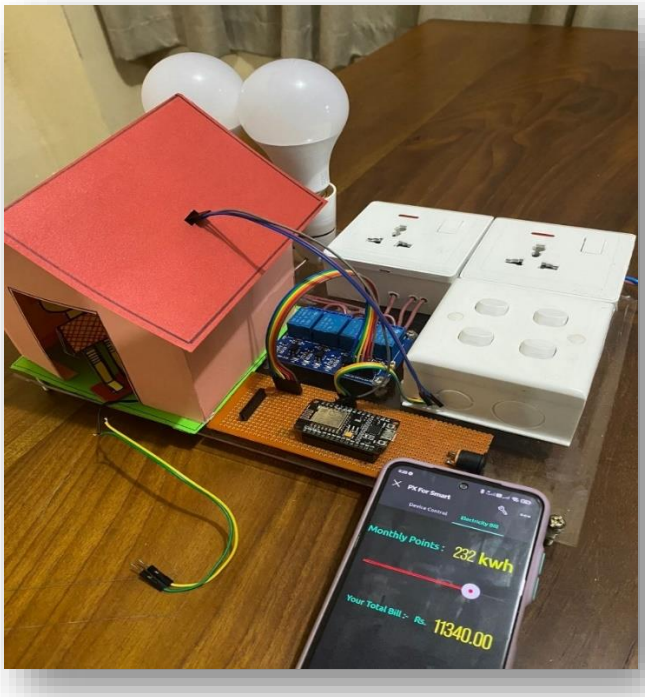
```
  BlynkEdgent.begin();
}

BLYNK_WRITE(V0) {
  Bulb1_Stat = param.asInt();
  digitalWrite(Bulb_1_Pin, Bulb1_Stat);
}

BLYNK_WRITE(V1) {
  Bulb2_Stat = param.asInt();
  digitalWrite(Bulb_2_Pin, Bulb2_Stat);
}

BLYNK_WRITE(V2) {
  int Switch1_stat = param.asInt();
  digitalWrite(Switch_1_Pin, Switch1_stat);
}

BLYNK_WRITE(V3) {
  int Switch2_stat = param.asInt();
  digitalWrite(Switch_2_Pin, Switch2_stat);
}

BLYNK_WRITE(V4) {
  int Monthly_Points = param.asInt();
  Bill_Genarator(Monthly_Points);
  Blynk.virtualWrite(V5, Desired_Total_Bill);
}

void loop() {

  int PIR = digitalRead(Motion_Sense_Pin);

  ManualControl(Manual_Switch_1_Pin, Manual_Switch_2_Pin, Bulb_1_Pin,
Bulb_2_Pin);

  if (PIR == 1) {
    Blynk.virtualWrite(V0, !PIR);
    digitalWrite(Bulb_1_Pin, !PIR);
  }
  BlynkEdgent.run();
}
```

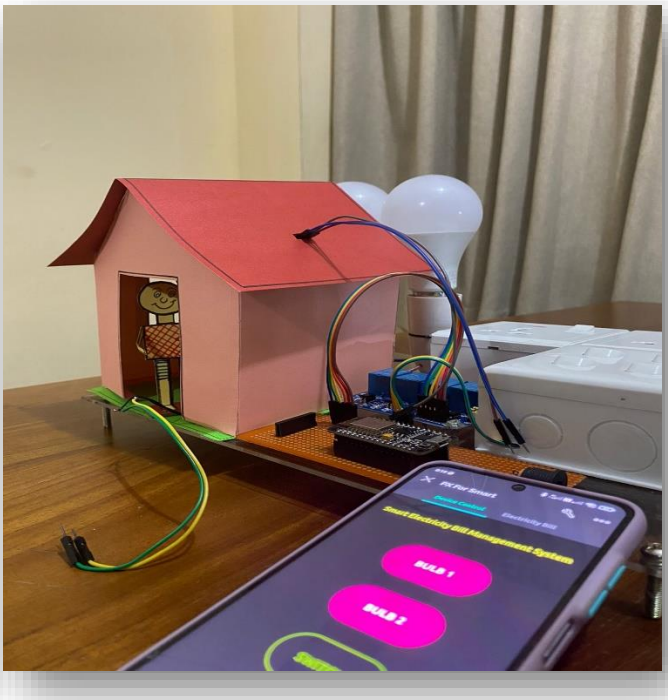
Code for electricity bill calculation [eBill_Functions.h]

```
float Desired_Total_Bill;

int Switch1_stat = 0;
int Switch2_stat = 0;
int Bulb1_Stat = 1;
int Bulb2_Stat = 1;

void Bill_Genarator(int Monthly_Points) {

  //---------------- Under 60 kwh ----------------------

  if (Monthly_Points <= 60) {
    if (Monthly_Points <= 30) {
      Desired_Total_Bill = (Monthly_Points * 8.00) + 120;
    } else {
      Desired_Total_Bill = (30 * 8.00) + ((Monthly_Points - 30) * 10.00) +
240;
    }
  }

  //---------------- above 60 kwh ----------------------

  else {
    if (Monthly_Points <= 90) {
      Desired_Total_Bill = (60 * 16.00) + ((Monthly_Points - 60) * 16.00) +
360;
    } else if (Monthly_Points <= 120) {
      Desired_Total_Bill = (90 * 16.00) + ((Monthly_Points - 90) * 50.00) +
960;
    } else if (Monthly_Points <= 180) {
      Desired_Total_Bill = (90 * 16.00) + ((Monthly_Points - 90) * 50.00) +
960;
    } else {
      Desired_Total_Bill = (90 * 16.00) + (90 * 50.00) + ((Monthly_Points -
180) * 75.0) + 1500;
    }
  }
  //---------------------------------------------------------
}

void ManualControl(int Manual_Switch_1_Pin, int Manual_Switch_2_Pin, int
Bulb_1_Pin, int Bulb_2_Pin) {

  int Switch1_Value = digitalRead(Manual_Switch_1_Pin);
```

```
  int Switch2_Value = digitalRead(Manual_Switch_2_Pin);

  Bulb1_Stat = digitalRead(Bulb_1_Pin);
  Bulb2_Stat = digitalRead(Bulb_2_Pin);

  if (Switch1_stat == Switch1_Value) {
    Switch1_stat = !Switch1_Value;
    Blynk.virtualWrite(V0, !Bulb1_Stat);
    digitalWrite(Bulb_1_Pin, !Bulb1_Stat);
    Bulb1_Stat = !Bulb1_Stat;
  }
  if (Switch2_stat == Switch2_Value) {
    Switch2_stat = !Switch2_Value;
    Blynk.virtualWrite(V1, !Bulb2_Stat);
    digitalWrite(Bulb_2_Pin, !Bulb2_Stat);
    Bulb2_Stat = !Bulb2_Stat;
  }
}
```

06.STRUCTURE OF PROTOTYPE





07.ISSUES

Problems arise in the calculation part when initially inputting the value of the expected electricity bill. Therefore, the expected number of units should be entered first. Therefore, it was difficult to get the number of related units by including the electricity bill as we expected in the calculation.

08.DISCUSSION

How much electricity bill is expected is obtained from the user as a keyboard input. The input given by them is stored and the expected electricity bill is received at the end of the month, the number of points to be used is calculated and the points to be used per day are calculated. If they spend more points in a day than the number of points that should be used for that day, a warning message will inform them to consume less electricity the next day. In order to help control the consumption of electricity, the user is informed about the light bulbs and electrical appliances that are turned on for nothing and after the user confirms that they are turned on for nothing, they are automatically turned off through the system. By using PIR motion sensor, it is used to check if anyone is in the room. If there is no such person, it is extinguished as above Also, by using an LDR sensor, the light intensity is checked, and the lights lit around the house are turned off.

09.CONCLUSION

This Smart Electricity bill management system can solve the main problem that people face in their daily life, the abnormally high electricity bills. I think this system is a good system for that.

10.REFERENCE

- https://www.electronicwings.com/nodemcu/introduction-to-nodemcu
- http://wiki.sunfounder.cc/index.php?title=4_Channel_5V_Relay_Module
- https://en.wikipedia.org
- https://eepower.com/resistor-guide/resistor-types/photo-resistor/#
- https://www.infratec.eu

FINAL REPORT

THE END

ICT 305 2.0
EMBEDDED SYSTEM

G.A.N.K. JAYALATH
R.P. YATALAMATHTHA